

Taylor - (T. M.)

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After Fracture of the Dorsal Vertebra.

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THOMAS M. TAYLOR, M.D.,  
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## A CASE OF SPINAL HEMIANÆSTHESIA AND HEMIPARAPLEGIA AFTER FRACTURE OF THE DORSAL VERTEBRA.

BY

THOMAS M. TAYLOR, M.D.

THIS case is recorded because it was by a study of similar symptoms which had been produced experimentally, and which were afterwards discovered clinically, that Professor Brown-Séquard succeeded in establishing many anatomical and physiological facts, and as he has by no means exhausted this special field, this will be of interest to those who follow him.

The patient, a German, aged twenty-two years, came first under treatment at the New York Polyclinic, neurological department, July 6th, 1883, when the notes given below were taken.

He is well nourished and apparently healthy. With the assistance of a cane he walks very awkwardly, like a hemiplegic with descending degeneration in the left half of the cord. The left lower extremity is stiff, as well as paretic, and with eyes closed he stands rather unsteadily. On removing the clothing, a well-defined kyphos is found in the spine, with its apex about the third dorsal vertebra. The head and neck, drooping forward from this point, give him a stooped appearance. Decided tenderness on pressure is limited to the region of this deformity. Movements of the upper spine in any direction, especially extension, and concussion in its long axis, produce pain which is invariably referred to the same part of the column. An

angular deformity in the middle third of the left clavicle is evidence of previous fracture in this situation, with much overlapping of the fragments. Head, neck, and upper extremities seem normal as to power, sensibility, and nutrition. Vision, respiration, and deglutition are uninterfered with.

On the left, side patellar tendon-reflex is greatly exaggerated, and ankle clonus present. On the right, while the knee-jerk is more than normal, the ankle phenomenon cannot be obtained. Cremaster reflex is absent on the left.

Power is very perceptibly below normal in the left limb, but just how much it is diminished it is difficult to say, owing to the great rigidity which pervades the extremity. No atrophy nor diminution of temperature as tested by the hand is noted in any part. A slight degree of vasomotor paresis may be present on the left side. Muscular sense is tested, but no satisfactory knowledge obtained on account of the patient's obtuseness. If impairment of this sense, however, be present, it cannot be marked. On the left side, below the level of the injury, sensibility to tactile, thermal, or painful impressions is at least as good as in other regions of the body, and to the last-mentioned variety it is abnormally acute; while on the right, or non-paralytic side, from the middle of the scapula behind and the nipple in front down to the sole, there is marked but not absolute analgesia. Perception of heat and cold is entirely absent over the same area; while tactile sensibility is quite equal to the opposite side or regions above the injury. Mild irritation, such as might be produced with the end of a pencil or the finger tickles the sole of the right foot; but on the left no sensation, except presence of the instrument is appreciated before pain is perceived. In other words, the left sole cannot be tickled. All temperatures are appreciated as "hot" by the patient on the right



side. In a narrow band stretching across the left scapula, from the median line a few inches below the deformity to the axilla, there is also diminution of thermal, and to a slight degree, of painful sensibility. Repeated attempts to discover a belt of complete anæsthesia with hyperæsthetic superior border, as is depicted in writings upon this form of paralysis,<sup>1</sup> are unsuccessful, though the band just mentioned may be interpreted as an example of the bilateral exposition of the sensory disturbances.

There is no delay in the conduction of impressions. Electrical responses are equal and normal on the two sides, and bladder reflex is also normal. To more easily compare the effect of the central lesion upon the two sides, the symptoms appearing in each may be thus arranged :

*Right Half of Body below Level of Deformity.*

1. Power, probably normal.
2. Atrophy, none.
3. Vaso-motor paresis, none.
4. Electrical response, normal.
5. Muscular rigidity, none.
6. Reflexes: (a) patellar tendon, slightly increased.
- b. Ankle clonus, absent.
- c. Cremaster, present.
- d. Plantar, normal.
7. Temperature, unchanged.
8. Sensibility (a) to touch, normal; (b) to tickling, present and well marked in sole of foot; (c) to thermal changes, absent; (d) to pain, greatly diminished.
9. Muscular sense, normal.

*Left Half of Body below Level of Deformity.*

1. Power, much below normal.
2. Atrophy, none.
3. Vaso-motor paresis, slight.
4. Electrical response, normal.
5. Muscular rigidity, marked.
6. Reflexes: (a) patellar tendon, greatly exaggerated.
- b. Ankle clonus, well marked.
- c. Cremaster, lost.
- d. Plantar, diminished.
7. Temperature, unchanged.
8. Sensibility (a) to touch, normal; (b) to tickling, none in sole of foot; (c) to thermal changes, except over scapula, normal; (d) to pain, increased, except as in c.
9. Muscular sense, normal.

The account of the accident and its sequel, given by the patient, is briefly this: On the 6th of May last, he fell from the third floor through an elevator shaft, striking the left side of head and shoulder. Consciousness returning

<sup>1</sup> Vide "Diseases of the Spinal Cord," by Bramwell, p. 64; or Ross on "Diseases of the Nervous System," vol. ii., p. 363.

after several hours, he suffered from distressing dyspnœa, with much pain in back and chest, both being greatly aggravated by movement. The dorsal decubitus, with head well elevated, was the one assumed as most comfortable. Urine was never drawn, but the bladder responded slowly for the first five days.

The most interesting feature, however, was complete loss of power and sensibility in the left lower limb, while he was able to move the right freely, and it felt natural to him when handled. There was no girdle sensation, and arms, shoulders, head, and neck were not implicated in the nervous disability.

At the end of two weeks, the dyspnœa was of very little moment, but pain still persisted in the upper part of the spine. He also began to appreciate some impairment of sensibility, especially to heat and cold, on the right side, the left limb having meanwhile improved.

During the fourth week, the left leg began to "shake" at times (reflex movements), and soon after this he was able to feel objects brought in contact with this limb. One week later, he could stand and walk a little, after which improvement steadily progressed.

Treatment consisted in the frèquent use of the actual cautery to the spine, more freely over the painful region, and the application of a steel spinal brace.

August 30th, 1883. The treatment has been attended with such success that for the past two weeks the patient has been steadily working at his trade, that of a tinsmith. After wearing the brace about two weeks, and having three applications of the cautery, pain was seldom appreciated, except on unusual movements, and power of locomotion so improved that the further use of his cane was found unnecessary. At this time his spine seems quite firm. Its functions are almost perfect, scarcely any pain remaining even on extreme extension. He walks with ease,



unsupported, but the left limb is still unwieldy, and its sole scrapes the floor as he steps.

November 12th, 1883. There is now only the slightest halt in his gait indicative of weakness in left limb. A certain amount of left lateral curvature of the spine has taken place below the site of the fracture, and the brace has been modified with a view to arresting this. Sensory paralysis and reflexes remain as first noted.

February 1st, 1884. Examination to-day shows the spinal deformity much unchanged, the head and neck carried more erect, and the lateral deviation so slight as to be of no consequence. His gait is almost faultless. Tendon-reflexes have changed very little since the first observation. They are still greatly exaggerated on the left, both at knee and ankle; on the right only at the knee. Power in left limb is not quite normal, but the rigidity has disappeared entirely.

Comparative measurement discovers less than one-half inch atrophy of left thigh, but considerable atrophy of the left gluteal region is apparent.

Electrical responses are similar on the two sides, except that when the pole is applied directly to the muscles of left leg, a little stronger faradic current is required than on the right.

The area of sensory impairment on the right side is somewhat reduced at the upper border, the limit now being at the level of the tenth dorsal vertebra and the umbilicus. The improvement below this line has been chiefly in the variety relating to temperature. For example, he can now appreciate marked differences anywhere above the lower third of this thigh with considerable exactness. An iron that has lain in a room with the ordinary temperature (about 70° F.), if applied is thought by the patient to be "warm;" on first examination, "hot" was the word he invariably used. But if allowed to com-

pare this with one slightly heated, he can always call them correctly. Below the right knee, no improvement seems to have occurred.

To painful impressions recovery is very slow. In no part below the line already indicated is it by any means perfect, and only a feeble effort toward the restoration of this function can be observed since the first note.

On the left side, over a small portion of the scapula, there still exists the same analgesia, but the ability to appreciate thermal changes has been re-established here.

Tickling is now normally acute on the soles of both feet. Hyperæsthesia still prevails on the left side. Temperature on this side decidedly lower than the right. Muscular sense remains unimpaired.

It will be seen that this case accords with the rarer form of the paralysis described by Prof. Brown-Séquard, wherein a part of the sensory fibres in the cord entirely escapes the *foyer* of inflammation, and those pertaining to the other varieties of sensibility are involved in different degrees. Though it is unusual to find a patient who from the first retains the power of appreciating one set of impressions, while to another he is anæsthetic, still it is not uncommon to have this interesting condition exhibited at some time during the process of recovery. In either instance, the explanation enunciated by the experimenter, whose name I have just used, must be accepted, viz., that fibres conducting each variety of sensibility have separate and distinct courses in the cord.

No attempt at the relative location of these tracts has as yet met with full credence at the hands of physiologists. However, evidence is from time to time accumulating to indicate that fibres carrying thermal and painful impressions cross to the opposite side immediately after entering the cord, and those for touch and tickling linger



for a time before decussation, while muscular sense ascends on the same side as the motor impulses descend.

The frequent limitation of the paralysis to painful and thermal impressions, other varieties remaining unimpaired, would lead to the inference that their tracts are very nearly associated in the cord. For cases illustrative of this point, beside the present, see *London Lancet* for 1865, Vol. II., p. 116; "Diseases of the Nervous System," by Rosenthal, pp. 267-8; Köbner's *Spinale Hemiplegie*; *Deutsch. Archiv für Klin. Med.*, Vol. XIX., p. 179, Case IV., and others.

A point with reference to the course of these fibres across the cord to their proper tracts in the opposite half is presented by this case.

Finding it nowhere alluded to, I think it not unworthy of note here. It will be remembered that my patient had loss of the same varieties of sensibility in a small area over the left scapula as prevailed so extensively on the right half of his trunk and lower limb, and to about the same degree, and that improvement here went *pari passu* with that on the opposite side. From this it may be inferred that the two sides are affected by a single lesion situated in one lateral half of the cord. To accomplish this, it is necessary that the affected fibres mingle at this point. Therefore, on entering the cord, these, in their course to the opposite half, must pass through the tract of similar fibres on the side first entered.







